

## DETAILED ACTION

### *Response to Amendment*

Claims 1-15 & 17-26 are pending in the application and claims 1-9 and 17-22 are withdrawn. Claims 10-15 and 23-26 are pending examination as discussed below.

### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

1. Claims 10-15 and 23-26 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for an intermediate electrolyte layer "wherein the average thickness of the electrolyte sheet situated under said at least one cathode and said at least anode is smaller than the average thickness of the electrolyte sheet not situated under said at least one cathode and said at least anode", does not reasonably provide enablement for a solid oxide electrode/electrolyte assembly comprising an electrolyte with the above feature. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make the invention commensurate in scope with these claims. Applicant has not provided the existence of working examples to illustrate the solid oxide fuel cell with the electrolyte layer conforming to the claimed features. The amount of direction provided by the instant specification does not lead one skilled in the art to make an electrolyte sheet with the claimed features. Applicant points to paragraph [0067] and figures 11A &

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11B of the instant specification for support of the claimed limitation, however, the description clearly teaches the thick portion  $t_2$  becoming the "via gallery". As illustrated in figure 5B, the "via gallery" (55) is a hole so no electrolyte is present and so there is no electrolyte there to be thicker than the portion under either of the electrodes.

Furthermore, none of the figures or descriptions clearly illustrates the claimed limitation to one of ordinary skill in the art.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 10-15 and 23-26 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Regarding claims 10 & 23, the limitation "not situated under said at least one cathode and said at least anode" is indefinite because the subject matter is not clearly pointed out. Figures 11A & 11B only show printing one electrode not both electrodes. Paragraph [0067] describes the thicker portion  $t_2$  being the "via gallery" which as disclosed earlier in the instant disclosure is a hole and so no electrolyte is present to be thicker than any other portion.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and

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the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 10-12, 15 & 23-26 rejected under 35 U.S.C. 103(a) as obvious over US Patent Publication 2003/0180602 (Finn) in view of US 2002/0012825 (Sasahara).

Finn teaches a solid oxide fuel cell with a textured electrolyte made with yttria-stabilized zirconia ceramic. One embodiment teaches an electrolyte having an average thickness of 20 – 10,000 microns and a surface texture of 5 – 1000 microns ([0195]). A predetermined re-producible pattern is used to texture the electrolyte sheet (Figs 13, 15, 16; [0186, 192]). The protrusions have a height of 5% of the average thickness, which can equate to a surface roughness of 2.5 microns ([0175]). The pattern is a sinusoidal pattern and as such, all the areas of the electrolyte that are not the peak area are thinner than the rest of the electrolyte sheet under the cathode or anode. The re-producible pattern is seen as product-by-process and as such even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process (MPEP 2113).

Regarding claim 10 & 23, since the electrolyte material is not taught as fully stabilized, it is being interpreted as partially stabilized and therefore the electrolyte layer is made from the same material and has the same thickness and features as the

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claimed invention. As such it is inherent that it has the same flexible property and an equivalent ohmic resistance as applicant.

Regarding claim 26, the electrolyte layer taught by Finn is made from the same material and the features are made by various chemical and mechanical methods. The thinner areas will have texture and therefore are textured.

Finn is silent to the average thickness of the electrolyte sheet under the electrodes being smaller than the portion not under the electrodes.

Sasahara teaches a solid oxide electrolyte sheet that has a textured surface (Fig.2 & 8, [0004, 00038]). The textured electrolyte sheet taught has an average thickness that is thinner under the electrodes than the portion not under the electrodes (Figs. 3-4; [0043, 0044]). The middle textured portion is the active area, the area with the electrode and the flat portion around the perimeter is known as the sealing portion and would not be part of the area under the electrodes. As illustrated in the figures, the average thickness of the outer portion is greater than the thickness of the active area. The thicker sealing portion allows the separator plate to be thinner, thereby decreasing the overall thickness of the fuel cell. While the sealing portion and the active area portions are not directly discussed by Sasahara, these features are well known in the art and further are clearly taught by Finn (Fig. 36; [0253]).

Therefore it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the electrolyte sheet of Finn with the thicker edge portions of Sasahara to enable a thinner fuel cell construction. Furthermore, the thickness of the sealing portion is a design choice and it would be obvious to one skilled

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in the art to alter the thickness of the two mating components to form a tight seal.

Combining prior art elements according to known methods to yield predictable results and using known techniques to improve similar devices in the same way are considered obvious to one of ordinary skill in the art (KSR, MPEP 2141 (III)).

4. Claims 10-15 & 23-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent Publication 2001/0044043 (Badding) in view of US Patent Publication 2003/0180602 (Finn) and US 2002/0012825 (Sasahara).

The teachings of Finn and Sasahara as discussed above are incorporated herein.

Regarding claims 10-14, 16 & 23, Badding teaches a partially yttria-stabilized zirconia electrolyte for use in a solid oxide fuel cell ([0003] & [0004]). The electrolyte is flexible and has a thickness of 5-20 microns ([0042]). Possible doping oxides for the electrolyte are selected from the group of Y, Ce, Ca, Mg, Sc, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, In, Ti, Sn, Nb, Ta, Mo, and W and mixtures thereof ([0044]).

While Badding teaches using an interface layer to roughen the electrolyte layer, he is silent as to the thickness variations and the pre-determined pattern.

Finn teaches texturing the electrolyte by 5% of the average thickness or 0.5 – 2.5 microns. Using the 2.5 micron height, the thickness variation is 12.5 – 50% the average thickness of the Badding electrolyte. While the 5% is not within the claimed range, claims that differ from the prior art only by slightly different (non-overlapping) ranges are prima facie obvious without a showing that the claimed range achieves unexpected results relative to the prior art (MPEP 2144.05). Claimed ranges of a result effective

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variable that do not overlap the prior art ranges are unpatentable unless they produce a new and unexpected result that is different in kind and not merely in degree from the results of the prior art (MPEP 2144.05). The pattern is a sinusoidal pattern and as such, all the areas of the electrolyte that are not the peak area are thinner than the rest of the electrolyte sheet under the cathode or anode. Regarding claim 26, the electrolyte layer taught by Finn is made from the same material and the features are made by various chemical and mechanical methods. The thinner areas will have texture and therefore are textured.

The motivation to use the texturing parameters of Finn is to improve adhesion and reduce the electrolyte/electrode resistance.

Therefore it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the electrolyte layer of Badding with the electrolyte roughening parameters taught by Finn to increase the adhesion between the electrolyte and electrode layers and reduce the resistance between the same layers, thereby improving the performance of the fuel cell.

5. Claims 13 & 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent Publication 2003/0180602 (Finn) in view of US 2002/0012825 (Sasahara).

The teachings of Finn and Sasahara as discussed above are incorporated herein.

Finn is silent to the electrolyte having an average thickness between 4 and 15 microns.

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Finn teaches a solid oxide fuel cell with a textured electrolyte made with yttria-stabilized zirconia ceramic. The average thickness is taught to be 20 microns ([0195]). Claims that differ from the prior art only by slightly different (non-overlapping) ranges are prima facie obvious without a showing that the claimed range achieves unexpected results relative to the prior art (MPEP 2144.05). Claimed ranges of a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result, which is different in kind and not merely in degree from the results of the prior art (MPEP 2144.05).

It would be obvious to one skilled in the art at the time of the invention to make a thinner electrolyte to reduce the overall thickness of the fuel cell. Furthermore, by making a thinner electrolyte, the resistance across the electrolyte layer is reduced, thereby improving the performance of the fuel cell.

6. Claims 10-15 & 23-26 rejected under 35 U.S.C. 103(a) as obvious over US Patent Publication 2003/0180602 (Finn) in view of US 2002/0012825 (Sasahara) and US 2001/0044041 (Badding).

The teachings of Finn and Sasahara as discussed above are incorporated herein.

Finn is silent to the electrolyte being partially stabilized.

Badding teaches a solid oxide electrolyte of yttria-stabilized zirconia. The amount of stabilization depends upon the desired features of the electrolyte. Badding teaches varying the amount of stabilization in order to alter ionic conductivity and

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strength. The electrolyte featuring the best balance of all the features is a partially stabilized zirconia electrolyte ([0036]).

Therefore it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the electrolyte sheet of Finn with the partially stabilized electrolyte sheet of Badding in order to maximize the beneficial features offered by the components of the electrolyte.

### ***Response to Arguments***

Applicant's arguments filed 9/15/08 have been fully considered but they are not persuasive. Applicant argues that Finn teaches a "fully stabilized zirconia electrolyte", citing paragraph [0202] of Finn as support. However, no support for this argument is found in the cited paragraph or anywhere else in the reference. "Fully stabilized" is not taught in the Finn reference. As stated above, since fully stabilized is not taught, the electrolyte composition is interpreted as being partially stabilized.

Applicant's arguments with respect to the claims have been considered but are moot in view of the new ground(s) of rejection as necessitated by amendment.

### ***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

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A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to whose telephone number is (571)272-3458. The examiner can normally be reached on Mon. - Fri. 8am - 5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached on 571-272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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